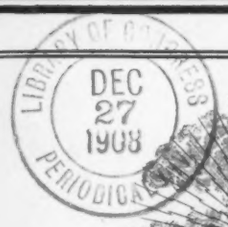
JOURNAL OF ELECTRICITY

POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy.

Entered as second-class matter May 7, 1906, at the Post Office at San Francisco, Cal., under the Act of Congress March 3, 1879

VOL. XXI NO. 25 SAN FRANCISCO, DECEMBER 19, 1908 PER COPY, 10 CENTS



726-728-730 Mission Street
San Francisco

OKONITE WIRE

THE STANDARD for RUBBER INSULATION

Okonite Tape, Manson Tape,
Candee Weather-Proof Wire,
Candee (Patented) Potheads.

THE OKONITE COMPANY, LTD.

253 Broadway NEW YORK

INDIANA RUBBER AND INSULATED WIRE CO.

Manufacturers of Paranite and Peerless Rubber Covered Wires and Cables
Underground, Aerial, Submarine and Inside Use
Telephone, Telegraph and Fire Alarm Cables
All Wires are Tested at Factory JONESBORO, IND.

Electric Appliance Company
728 Mission St., San Francisco Pacific Coast Agents

Standard Underground Cable Co.

MANUFACTURERS OF

BARE AND INSULATED WIRE AND CABLES

Chicago Pittsburg Philadelphia Atlanta
New York Boston St. Louis San Francisco

PACIFIC COAST DEPT. --- A. B. Saurman, Manager
Sub-Office—Los Angeles, Cal. Shreve Bldg., San Francisco

The Highest Grade

"Red Core," "White Core,"
"Black Core," and all kinds of
Telephone, Telegraph, "Code" and special wires
Signal, Submarine, Mine, Torpedo and Underground Cables

HABIRSHAW WIRE CO., 253 BROADWAY NEW YORK

Specify....

BROOKFIELD
GLASS INSULATORS

The Standard

PACIFIC METER CO.

MANUFACTURERS OF

Wet and Dry Gas Meters, Station
Meters, Provers, Guages, Etc.

301 SANTA MARINA BUILDING
California and Drumm Sts. San Francisco

VULCAN ..... Refrigerating and Ice Making Machinery

MANUFACTURED BY

VULCAN IRON WORKS

Office: 702 Atlas Bldg., 604 Mission St.
Works: Francisco and Kearny Streets San Francisco

FOR INDEX TO ADVERTISEMENTS SEE PAGE EIGHT

BATTERY CALL TELEPHONES

SELECTIVE RINGING

LIST $10.00

Catalog and Discounts on Application

COUCH & SEELEY, MFRS.

STOCK CARRIED BY

Standard Electrical Works

141 New Montgomery SAN FRANCISCO Phone Kearny 1077

Siemens Arc Light Carbons

BROOKS-FOLLIS ELECTRIC CORPORATION

SAN FRANCISCO, CAL.

44-46 Second Street Phone Kearny 1800

KLEIN'S

FOR HEAVY PULLS

"QUICK SAMPSON" GRIP

GET THE HABIT To Specify KLEIN'S And You will not Use Others

363 S-FOR STRAND WIRE

363 B-FOR TROLLEY WIRE

Carried on the Coast by all prominent supply houses from San Diego to Seattle. Get our catalogue and order by number.

MATHIAS KLEIN & SONS 95 W. Van Buren St., Chicago, Ill.

TOOLS

Columbia Tungsten Lamps

25 watt standard package 100 list price .85 clear, .90 frosted
40 watt standard package 50 list price 1.10 clear, 1.15 frosted
60 watt standard package 50 list price 1.40 clear, 1.47 frosted
100 watt standard package 24 1 st price 1.75 clear, 1.85 frosted

On orders for standard package quantities, small extra net charges made after which transportation charges to destination allowed.

We also have a full line of Tantalum Lamps, Gem Lamps and Carbon Filament Lamps.

Write for prices and all other information.

THE COLUMBIA INCANDESCENT LAMP CO.

ESTABLISHED 1889

MAIN OFFICE AND WORKS

ST. LOUIS, MO.

PACIFIC ELECTRICAL WORKS

326 So. Los Angeles Street LOS ANGELES, CAL.

SIMPLEX

FOR

Suburban Underground Connections

USE

Steel Taped
Lead Covered Cables

No Conduit
Quickly Installed
Few Joints

INSULATED

WIRES and CABLES

RUBBER — CAMBRIC

THE SIMPLEX ELECTRICAL CO - BOSTON

JOURNAL OF ELECTRICITY
POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy.

VOLUME XXI. SAN FRANCISCO, DECEMBER 19, 1908 NUMBER 25

A PLATE GLASS SWITCHBOARD*

A switchboard made of plate glass has just been installed for the use of the students in the science department of the San Jose High School, at San Jose, California. There are several points in connection with this which will prove of interest. It is believed to be the first of its kind, but, on account of the success attending its use, it will undoubtedly be duplicated. It is particularly useful for the instruction of students, as it gives a complete view of the path taken by the electric current from the front and also shows the position of the switches from the back. On account of the complex nature of the work, its installation was personally superintended by Mr. Martin Neugard, of Henry Neugard & Co., of Chicago, who installed the equipment.

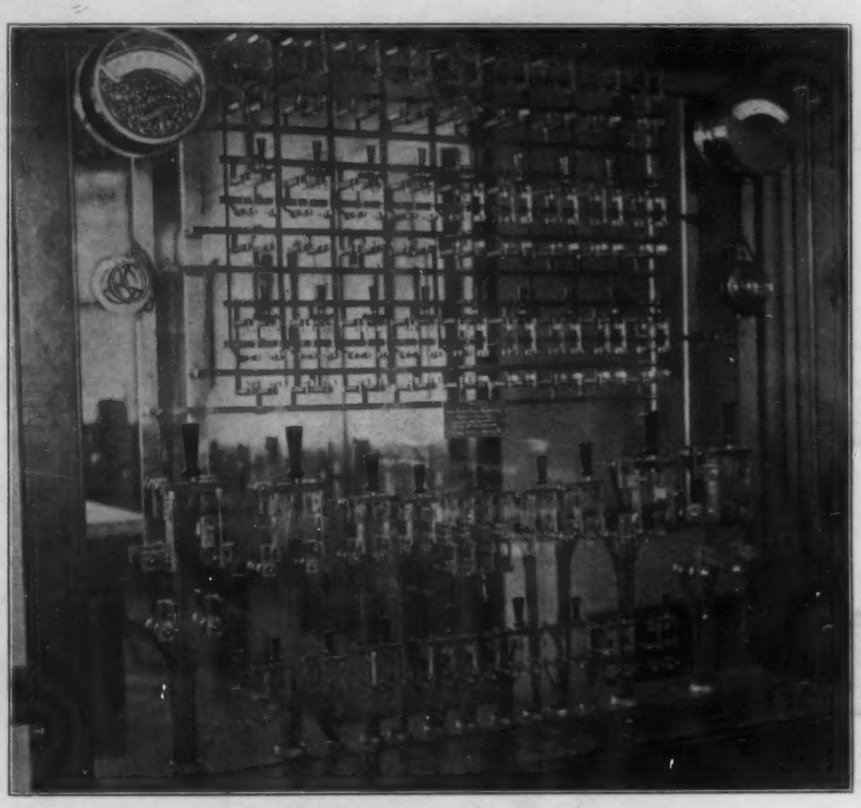


Plate Glass Switchboard at San Jose High School

The board is the distributing center for the various students' tables throughout the electrical laboratory in the science building. The current is furnished by Fort Wayne motor-generator set in the same building. The board is equipped for low and high voltage direct current and phase work, thus supplying a great variety of current for experiment.

The board is six feet high, eight feet wide, and one inch thick, and consists of a great piece of plate glass furnished by the Pittsburg Plate Glass Company. All of the holes for the insertion of the apparatus were drilled it the factory. There are 650 holes, ranging from 3/8 to 7/8 inch in diameter, and were drilled at a cost of 35 cents each.

The switches, fuses, and instruments for this board were all assembled and mounted on a wooden board in Chicago before shipping to San Jose, where they were transferred to the glass board. The switches, fuses, and bus-bars are of high polish and lacquered, thus giving the board a very beautiful appearance. In the construction, not a washer was used on the studs. As the heels of the switches were rough, they were backed with gold paper in order to maintain the general appearance. The switching arrangement is as follows:

One 150-ampere, double-pole, double-throw switch on each side, connected with twenty-nine 35-ampere, double-pole, double-throw switches with continuous bus-bars (these furnish high and low direct and alternating current for the individual students' tables); two 100-ampere, double-pole switches for 1 to 12 volts direct current; two 75-ampere double pole switches, 110 volts direct current; two 50-ampere, double-pole switches for single-phase alternating current; two 25-ampere, 4-pole switches for 2-phase alternating current; two 50-ampere, triple-pole switches for three-phase alternating current; two 50-ampere, double-pole switches for single-phase lighting circuit.

The instructors' tables are supplied with evaporating pans, wireless telegraph apparatus, X-ray equipment, and various extra connections. For these purposes, the switchboard is equipped with one 25-ampere, double-pole switch for the evaporating pans; one 25-ampere, double-pole switch for the 60,000-volt wireless coils; one 25-ampere double-pole switch for the X-ray apparatus; and two 25-ampere, double-pole switches for the extras. There are two voltmeters on either side of the board connected to a six-point switch for detecting grounds and indicating alternating and direct current. All the connections on the board are made from above, so that no wires cross, and the whole is rigid and plumb.

This board will greatly facilitate a ready comprehension of the intricacies of switchboard connections. For schools and colleges a board of this character will be useful. But for the hard service of commercial work it will hardly prove durable when compared with the usual slate of marble panels.

*Report of talk by Mr. John H. Clover before the Electric Club, San Francisco, December 12, 1908.

WESTINGHOUSE RECEIVERSHIP ENDED.

The Westinghouse Electric & Manufacturing Company has again become the property of the stockholders, after having been in the hands of receivers since the 23rd of October, 1907.

The petition for the discharge of the receivers was made on December 5th in Pittsburg, Pa., before Judge Young of the United States District Court of the Western Circuit of Pennsylvania, and was immediately signed by him. The petition was presented by G. B. Gordon, Esq., attorney for the receivers and for the Merchandise Creditors Committee; Paul D. Cravath, Esq., attorney for the Stockholders Committee, and A. H. Larkin, Esq., attorney for the Readjustment Committee. Mr. Gordon made the address to the court, in which he gave a statement of the company's affairs prior to the receivership, explained the causes which led to the establishment of the receivership, presented a report of the operation of the company during the tenure of the receivership, and finally led up to the great work which has been accomplished within so short a time by Mr. Westinghouse and the various committees in bringing about the rehabilitation and reorganization of the company. He emphasized the fact that during the year the receivers had been in charge they had not only succeeded in paying off the interest on bonds, as it fell due from time to time, but that they also kept the large factories of the company in operation during the entire time, doing an excellent business at a net profit of over $1,000,000.

The action of 5,000 employees subscribing for $600,000 of stock of the company was another feature presented to the court, which made a great impression, because it demonstrated the amount of confidence the employees themselves had in the company. It was also brought out that the company under the reorganization would in every way be in a better condition than at any previous period in its history, as it would start upon the new regime with cash on hand amounting to upwards of $15,000,000, with an indebtedness of only about $200,000.

Mr. Cravath in addressing the court on behalf of the Stockholders Committee, stated that in the annals of receiverships, this one stood without a parallel as the most successful.

The Board of Directors held a meeting in New York Monday, December 7th, and organized as follows: President, George Westinghouse; temporary chairman of Executive Committee, E. C. Converse; first vice-president, E. M. Herr; second vice-president, L. A. Osborne; acting vice-presidents, G. W. Hebard and W. M. McFarland; secretary, Charles A. Terry; treasurer, T. W. Siemon; assistant treasurers, E. St. John and H. F. Baetz; auditor, J. C. Bennett.

EXAMINATION FOR ELECTRICIAN'S HELPER

The United States Civil Service Commission announces an examination on January 13, 1909, to secure eligibles from which to make certification to fill a vacancy in position of electrician's helper, $50 a month, in the office of the Secretary, Department of Agriculture, and vacancies requiring similar qualifications as they may occur in any branch of the service. With reference to the specific vacancy mentioned the Department states that the length of time that it will be able to retain the services of an electrician's helper depends on the amount of work that comes into the shop, and also the funds available for the employment of a helper, both of which are impossible to determine in advance. The examination will consist of letter-writing (a letter of not less than 125 words on some subject of general interest. Competitors may select either of two subjects given); practical questions, elementary in character, relating to the wiring of buildings and installation and care of minor electrical apparatus; experience as electrician's helper (rated on application).

SOME CORRECTED FAULTS IN SINGLE-PHASE ELECTRIFICATION.

In the course of a valuable paper on "The Log of the New Haven Electrification," presented at the meeting of the American Institute of Electrical Engineers, New York, Dec. 11, 1908, W. S. Murray found that several serious faults developed in the power-house line insulation, circuit breakers, trolley wire, and locomotives. How these were corrected is shown in the following abstract:

Power house. The electric power supply for the New Haven road is derived from four 11,000-volt steam turbine generators, three of which have an electrical capacity of 3,750 kilovolt-amperes single phase; the fourth unit consisting of a 6,000-kilovolt-ampere, three-phase generator, which can also supply single-phase current to the system.

Although the generators as originally designed were made exceptionally strong, and particular attention paid to their insulation, due to the necessity of grounding one phase, it was found that the utilization of so much single-phase current from a three-phase star-wound generator produced a stray magnetic field completely out of the path of normal lamination. As a result it was impossible to develop for continued operation more than 66% of the normal rating of the generators. Overloads of any character produced abnormally rapid heating, making such operation dangerous, although the generators were guaranteed to carry 50% overload for two hours, and 100% overload for two minutes in order to meet the sudden drafts of currents required for a schedule such as exists on the New Haven road. Indeed, at the very start the actual drafts of current showed that the generators must meet imperatively the guarantees as to normal and overload capacities if the electrification were to be successful. These, then, were the power-house conditions that confronted the New Haven road on beginning the work of propelling alternating-current trains. The power house being the heart of an electric system, to add more would be to say less in describing a critical situation.

I trust it is not to be my pleasure to meet the prophet who says, "This could have been anticipated." Suffice it to say that after three unsuccessful attempts at complete correction, each, however, affording some constructive results—months being absorbed in the dismantling and readjusting of the parts of these generators—the final attempt was successful and the generators are today operating in the power house, fulfilling the guarantees mentioned previously. But this last-mentioned fact is insignificant when compared with the valuable information that has been derived, which will permit all other generators to be manufactured without the fault described.

Line insulation. The years of experience which we have had in the study of insulating various voltages led to what was considered a very conservative insulation in the various parts of the line. Messenger cables had to be insulated from the intermediate trusses and at their anchor-bridge termini. The trolley copper conductor was suspended from the messengers and had to be insulated at points where it entered the oil switches on the anchor bridges. Trolley wires had to be insulated from each other at section breaks. On curves, both messengers and trolley wires had to be strained over the center of the tracks through the agency of pull-off posts at the side of the tracks, the pull-off wire being insulated between tracks and the pull-off column itself. Feeder wires had to be insulated from their supporting cross-arms and at points where they pass under highway bridges. None of these problems in insulation had the appearance of an especial character and, indeed, did the roadbed provide traffic only for electric trains, the problem would have been simplicity itself. A pressure of 11,000 volts being the prevailing dielectric strain, the problem was to provide sufficient insulation at all the points mentioned above.

Of the effect of steam locomotive discharges upon insulators, there was no initiative by which to be guided, and it became necessary to decide upon the factors of insulation that would be

required. It was thought that ample provision had been made: it proved otherwise. Experience has proved that, in places, just double the amount is required. It was quickly noted that the greatest number of insulator failures occurred wherever the insulation was subject to the direct blast of the steam locomotive. To correct the difficulty, therefore, it was found necessary to double up on anchor insulators. The intermediate messenger insulators proved adequate and it was not found necessary to increase the impregnated stick insulation between trolley wires at curves, but wood stick insulators had to be added in series with the moulded material insulator between the pull-off wire and pull-off post. The original insulators on the anchor-bridge switches were made of moulded material and for them was substituted porcelain. It was not necessary to change the feeder insulators on the catenary bridge struts. While very little trouble has been experienced with the form of insulation used for supporting the feeders under highway bridges, it is anticipated that trouble will follow if this is not changed. The present form consists of the corrugated spool-type insulator, for which there will be substituted a regular porcelain double-petticoat insulator.

Today, instead of line failures being the rule, they have become the exception.

Circuit-breakers. The momentary energy involved in a short circuit produced upon a line fed by high-power, high-speed turbines is very great. Under the sub-title *"Power house"* it was stated that the generators were operating under their guaranteed capacities. Internal heating, due to stray magnetic field, was the cause of the generators failing to meet their designed capacity. This heating was completely cured by the simple addition of a short-circuited winding surrounding the rotating member of the generator, similar to that used in the well-known squirrel-cage type of induction-motor rotors. It is interesting to note here, however, that while the heating is entirely eliminated by this short-circuited winding, its effect on the occasion of a short circuit is to allow more current to flow. This tendency, however, is controlled by a method later to be described. In the New Haven system, as the current from the power house was fed directly to the line and from there to the locomotives without transformation of voltage by transformers, the inductive element to counteract the surging current was practically negligible; under these conditions there resulted short circuits which no circuit-breaker apparatus then designed could be relied upon to take care of.

Here it is expedient to point out the very marked difference in operating conditions between circuit-breakers used on a system that is grounded and one that is not. In either case, it is, of course, good practice to ground the frames of all circuit-breaker apparatus. In the case of the grounded system, this virtually brings one terminal of the generating system directly to the frame of the circuit-breaker; with the other terminal of the system connected to the jaws (contactors) of the breaker, it is readily seen that on the occasion of a heavy current surge, due to short circuit, should the arc extend itself through the walls of the oil tank (wherein the circuit is broken), this would be a direct leakage to ground establishing a short-circuit around (or in shunt) to the circuit-breaker jaws, which action, of course, renders the circuit-breaker useless, and subjects it to the damaging effect of the arcing locally produced until interrupted by another circuit-breaker in series with the circuit. On the other hand, where the system is not grounded, even should the walls of a circuit-breaker be broken down, as explained above, there would be no electrical connection (unless the neutral be grounded) between the circuit-breaker frame and the generator, and thus no return path for the current. I desire to draw particular attention to this point, for while the circuit-breakers used in our case open short circuits, since the current surges have been practically eliminated, I believe that the lining of the oil tanks should have an especially high insulation factor on grounded systems.

The failure of circuit-breakers, either in the power house or on the line, naturally produced train delays of large or small magnitude. It was difficult to believe that these large circuit-breakers were incapable of taking care of the short circuits, and some time was wasted in thinking this way. Therefore, we reluctantly but surely arrived at the conclusion that the conditions would have to be changed.

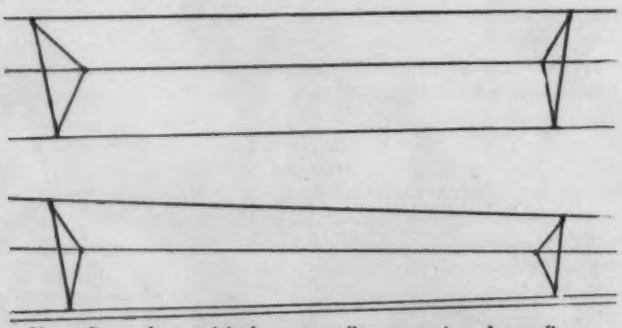
The remedy was simple. Instead of feeding the main line with a direct transmission straight from the power-house bus-bars to the trolleys directly opposite the power house, the current was fed into the line over feeders connected to it at Port Chester and Stamford. By the introduction of this ohmic resistance, amounting to not more than 2 per cent normal drop on the system, we were immediately released from the disastrous effect of short circuits on our circuit-breaker apparatus. Instead of losing as many as half a dozen circuit-breakers in a day, not that many were reported out of commission for a month, and, of course, they were not damaged to the extent as the others nor did they cause any serious delays.

For the feeder resistance, above described, there has since been substituted impedance coils installed in the leads of the generators. These coils act as shock absorbers, protecting the generators. Later, it is to be expected that there will be installed a circuit-breaker across the terminals of these impedance coils, which, for normal operation, will shunt the current through them, the breakers opening under stress of abnormal flow of current and automatically closing when normal conditions are restored.

Trolley wire. In the month of May, 1908, it became evident to us that within at least one month from that date, if some change were not effected in the contact wire, that the New Haven electric service would cease. While this truth was so plain, it may be best described by the fact that daily reports were showing that the copper trolley wire was breaking at various points; and where it was not broken it had become so badly kinked at the hanger points that it was impossible to operate electric locomotives upon the line without serious arcing. This resulted in violent surging on the locomotive transformers, and at times, on account of the extremely poor contact of overhead shoes on the line, in reducing the voltage to such a low value as to prevent a sufficient supply of power to enable the locomotive to perform its schedule. An examination of the hard-drawn copper trolley wire throughout its length proved that even after only a few months' operation upon it, its cross-section had been so materially reduced as to point to its short life with a continuance of operation upon it. Especially was this true in the vicinity of the many low highway bridges where the trolley wire approaches the bridge on a two per cent gradient. This fault and dilemma were indeed serious. The cause of the difficulty was perfectly apparent, namely, the hard spots in the line which existed at the hanger points.

Many suggestions were offered. None of them, however offered the speedy installation that was paramount. Mr McHenry, vice-president of the New York, New Haven & Hartford Railroad Company, made the suggestion that an auxiliary wire be suspended from the present copper wire by clips at its midpoint between the hangers, and followed up the suggestion that this auxiliary wire be made of steel, of the same cross-section as the 0000 grooved hard-drawn copper above it. It took two weeks for the manufacturer to draw two miles of this wire. It was installed immediately upon its receipt on the main line between Port Chester and Harrison. On the night of its completed erection, a special seven-car train with two locomotives was operated upon it for several hours. Previously to the installation of the steel wire there had been installed a section of hard alloyed wire suspended in a manner similar to that of the steel. The electric train was operated upon them both, officials from both the railroad company and the contracting company being on hand to note their comparative merits. It was the general consensus of opinion that there was less sparking on the hard wire, and the general

tendency was towards adopting that rather than the steel. Though admitting that the operation was better, the steel seemed to be of an entirely satisfactory commercial nature, and all present finally concurred in this conclusion. It is undeniably true that hard alloyed wire would, from a purely operative point of view, be the better of the two, and yet the commercial aspect, which would naturally include its cost, had to be considered, particularly in reference to so large an immediate order as one involving 100 miles of single-phase electric trackage. Again it is important to note that the steel, besides having the advantage of being a cheaper, harder, and stiffer wire, also possesses a lower co-efficient of expansion and higher elastic limit, especially valuable characteristics for the service desired. We found that we would be considerably delayed in the delivery of the steel, but an immediate order of 20 miles followed by another for 40 was placed, and as much hard alloy wire put up as could be obtained between the date of the conclusion to use the auxiliary wire and the final arrival of the first shipment of steel. The auxiliary wire construction on the main line, as described, prevails throughout the whole system, except at the approaches of and under a few very low highway bridges, where the contact system consists of two wires strung in the same horizontal plane.



Upper figure shows original copper trolley suspension. Lower figure shows auxiliary contact wire suspended from upper trolley wire.

The New Haven trains have been operating now on the auxiliary wire for several months, and absolutely no kinking has been noted at the hanger points, with the attendant result of a smooth and almost sparkless overhead contact.

Locomotives. There were originally purchased 35 locomotives, which was considered an adequate number to take care of the New Haven passenger service. These locomotives, considered *per se*, were rated on a half-unit basis. That is to say, the half unit was designed to handle about 75 per cent of our trains, the remaining 25 per cent to be handled by two units. Only a short experience in commercial operation revealed two important facts. The first one of a very encouraging nature, the second, decidedly otherwise. The first was the proof that the two main parts of the locomotive, namely, the transformer and motors, had sufficient capacity to more than handle the manufacturer's guarantees. The second was the discovery that many of the auxiliary electrical and mechanical parts of the locomotive equipment were not of equivalent capacity. The strength of the chain being measured always by its weakest link, it was immediately seen that the locomotives would be able to handle trailing loads in excess of their guarantees if the auxiliary parts were made of sufficient capacity to furnish the necessary current for the overload conditions. It was simultaneously apparent that more locomotives would be required to provide for an increase of train service and the reduction of time schedule, and an order was promptly placed for six additional ones; before accepting their design, however, a careful survey was made of all the component parts of the locomotives at hand, in order to determine the changes necessary to be incorporated in the six new engines. To accomplish this is was found necessary to make a number of electrical and mechanical changes, the nature of which is apparent in the following tabulation:

The most important electrical changes made were in the switch-groups and brush-holders of the motors. The former lacked carrying capacity and the latter sufficient insulation. To these shortcomings were due the greatest number of our first train delays. The most important mechanical changes necessary were the reinforcement of the truck bolsters and installation of pony wheels. The especial reference to these electrical and mchanical changes must not be construed as diminishing in any way the force of necessity of the others, as they were all considered absolutely necessary in order to preserve a low cost of electrical and mechanical maintenance.

With the exception of the installation of pony trucks, the six new electric locomotives arrived within five months of the date of their order. In their design were included all of the changes above specified. To be noted here is the marked value of the spring type of armature and field suspension begun with the New Haven locomotive motors, thus making flexible the entire motor suspension. Indications already predict that this arrangement in combination with the pony trucks will reduce materially the track and locomotive maintenance and repairs. Today the reconstruction, as above described, has been effected on over 90 per cent of our locomotives.

This last and serious fault with which we had to contend completes the major difficulties that were constantly threatening the regularity of electric service.

It seems to be the time and place, here, to draw attention to a point in design concerning the New Haven locomotives that has been so persistently misrepresented by those who seem to have been ignorant of the facts. The specifications upon which the locomotive units were purchased, as stated hereafter, were that each unit would handle a normal trailing load of 200 tons. The writer, by careful measurement of the weights of all the trains (trailing loads) in the New Haven service, found that they averaged 212 tons. It seemed good engineering that if 75 per cent of the service could be handled by locomotives rated upon a basis of 200 tons trailing load, that that would be the correct locomotive unit size; using two units for the remaining 25 per cent of the trains. Today, three years after this decision, we find that 73 per cent of our trains can be handled with single units, 27 per cent requiring two units. The percentage is slightly different from the original, as the service is slightly heavier.

Coincident with the use of the first double-unit locomotive trains there was started a rumor that the New Haven locomotives did not have the capacity for which they were designed. To dispel this idea forever, I judge the best argument is to refer to Table X, wherein are stated the trains whose weights were in excess of trailing loads the locomotives were designed to carry.

I trust that the above clears up any erroneous ideas concerning the capacity of the New Haven locomotives, and will justify the future double-unit trains entering and leaving the Grand Central Station.

Recapitulating, I believe my brother engineers will agree that with the coincident difficulties described in our power house, line, circuit-breakers, trolley wire, and locomotives, the work of instituting electric service was not exactly laid over a bed of roses. These are the serious faults the system possessed and the description of our method of elimination of them that I am glad to be able now to place before you. We cannot blame the public for making the complaints they have against the New York, New Haven & Hartford Railroad Company's electric service, for to the traveling public there is nothing so exasperating as a train delay. It is fitting here also to say how appreciative the engineers of the New Haven road feel for the calm and generous suspension of judgment on the part of those engineers who have reserved opinion until it could be based on facts which time only could so demonstrate as to permit presentation. There are many other little faults and difficulties here and there throughout the system, but the five described, though not fundamental in their effect, since they have been removed, were none the less the most serious.

OBLIGATION OF ELECTRIC COMPANIES IN THE UNITED STATES TO PLACE GUARDS OVER THEIR WIRES.

By Emerson W. Read, B. L., L. L. B.
(Member of the San Francisco Bar.)

Various rules have been laid down in the State Supreme Courts of the United States over the duty electric companies owe to place guards over their power lines. It is peculiar that the power lines of railways have, more than any other, been the subjects of litigation in this particular regard. A hasty examination of the cases shows that the injuries arising from the absence of guards over power lines have happened to a large per cent in streets where the street railway wires were suspended over public thoroughfares through which numerous persons pass in a day. In other words, street railway wires exist in crowded communities where the fall of a wire must necessarily mean greater danger and possibility of injury than on public country roads or private property. As a result of this greater hazard within city limits the duty to guard wires has been most stringently enforced.

That various rules have been decided upon by the various State courts is a result of many considerations. The main one of these is that courts appreciate fully the immense cost of stringing, supporting and maintaining wires. To require that elaborate support or guard contrivances be adopted and used by companies is really to add to the cost of construction and, through the career of the company, to the cost of maintenance. In those States where popular sentiment and Legislative action already are operating to make the management of large corporate interests unnecessarily burdensome, to add this further expensive obligation would render, in some cases, the undertaking and investment hazardous.

The Supreme Court of Tennessee has spoken on this duty. Turney (C. J.) rendering the decision of that tribunal in Electric Ry. Co. vs. Shelton, said: "While it was the primary duty of the telephone company to see that its wires were in a reasonably safe and sound condition and protected against the contingency of falling, it was also the duty of the electric company to see that its trolley-wire was in like manner protected from such contingency. While it was the duty of one company not to use unsound and unprotected wires, it was equally the duty of the other not to operate its road under such defective machinery. It might as well insist that it was not responsible for damages resulting from the fall of a rock which it had constantly recognized as threatening to fall, or of a dead tree which it had frequently noticed with decayed and giving roots, and knew would fall in the first wind or rain. The obligation to see that its road was in good repair, and its machinery in safe operating order is not confined to the immediate and abstract presence of either, but extends to all surroundings that may depreciate the security of either. Both companies knew of the unprotected trolley-wire, and the consequences of a contact of the wires of one with those of the other. Both knew of the unsoundness likely to produce a fall of the one upon those of the other. Both were bound to guard against such likelihood, and having failed to do so, are liable." This decision is enforcing the rule most stringently when it is considered that the falling of the walls of a blazing building directly caused the fall and contact of the wires. The court, in that case, implied that a "guard" would be provided had a "guard wire (been placed) over the trolley wire."

The rule followed by the court in City Electric Ry. Co. vs. Conery (61 Ark.) was adopted on the theory that "telephone and other corporations and persons using electricity in the public streets owe a duty to all persons lawfully using such streets, that the use shall be substantially as safe as before the telephone or other electric plant was placed therein." This standard of care is as high as any ever adopted by a court. It may be beyond the reach of "guards" or precautions of any kind. Possibly it is too stringent and may be impracticable if enforced in that form.

A more modified rule is that arrived at by Alabama in McKay vs. Southern Bell Tel. Co. (111 Ala. 337). Quoting from the Am. St. Reports the rule, in that case is thus stated: "But although a railway company erects and maintains its trolley wires as erected and maintained by many prudent and well-managed corporations conducting a similar business in other cities, it is negligent where it knowingly suffers a wire of a telephone company to be suspended above its own in a condition likely to fall across its own, involving danger to persons and property in the street without providing proper safeguards."

Wisconsin has decided that no standard of guard should be decided upon; what must be expected reasonably of the company is a question of fact to be decided by the jury in the face of existing circumstances. In Black vs. Milwaukee St. Ry. Co. (89 Wisc. 371) it is said: "It may well be that the dangers attending its use in that function, and the best mode of guarding against accident in its use, are not yet fully known and understood. Many of the phenomena and possibilities of the danger attendant upon such use are still subjects of question and experiment. But notwithstanding this condition of imperfect knowledge, the law permits this mysterious and dangerous power to be used for locomotion in the streets of cities. It is lawfully there. No doubt it is the duty of the defendant to use such customary and approved appliances as are known and used in the business of operating electric railways. So far as reasonable knowledge in the present state of the science and the practical use of electricity as a motive power for street railways, and reasonable foresight, can go, it is bound to guard the public against the perils attendant upon this use of electricity. But it is liable only for what is known as reasonable care. The present state of the science, and the present practical knowledge of the most practical and effectual means and methods of guarding against such perils as are incident to its use, are a most important element in the question of what is reasonable care. In the present condition of the science and of the practical knowledge of this subject, it cannot be said, as matter of law, what method of guarding the wires shall be required, nor whether any guards shall be required; for it is not known to the law that any method now known will prove effective. But it is a question for the jury, under all the facts in the case, to determine whether the method actually used was negligent." This rule is far more lenient than the ones shown above. In the absence of legislative enactment on the subject, perhaps it shows, more consistent judicial policy. Too much comment on "judge made law" is before us already.

In this same connection the case of Spires vs. Middlesex etc. Power Co. (N. J. L.) is interesting. That case holds: "Where a wire passes under a heavy limb of a tree in a highway and is charged with a powerful electric current, the duty of the electric company requires it to guard the wire so as to prevent its being broken by the possible falling of the limb."

EXAMINATION FOR ASSISTANT ENGINEER OF TESTS.

The United States Civil Service Commission announces an examination on January 6, 1909, to secure eligibles from which to make certification to fill a vacancy in the position of assistant engineer of tests (male), $1,200 per annum, Ordnance Department at Large, Watertown Arsenal, Massachusetts, and vacancies requiring similar qualifications as they may occur in any branch of the service. The examination will consist of applied mechanics, strength of materials, testing apparatus and methods, experience in manipulation and test making (rated on application). Applicants should give in their applications a clear, complete, and detailed account of their experience in the manipulation of testing machines and in the making of tests, stating every detail in proper order of time and omitting nothing that may enable the examiner to form a correct estimate of the value of their experience.

SOME POSSIBILITIES OF THE GASOLINE TURBINE*

By Frank C. Wagner.

In considering the possibilities of a gas turbine it has commonly been assumed that the gas should be burned with something near the theoretical quantity of air required for complete combustion, as is done in the explosion gas engine of the ordinary type. Under this condition the temperature of the gases when they strike the turbine wheel is so high that the metal of the wheel reaches a temperature at which its strength is seriously diminished.

It may be possible to pass water through the turbine wheel and keep down the temperature of the body of the wheel. But the blades, being long and thin, would become much hotter than the body of the wheel, and to pass water through the blades themselves would complicate the construction of the wheel enormously.

Two methods of reducing the temperature of the gases themselves are possible. One method is to use an excess of air in burning the gas or gasoline, sufficient to keep the temperature of the gases after expansion in the nozzles within safe limits. The other method is to inject a liquid, preferably water, into the gases. The liquid absorbs heat, becoming superheated vapor, and the vapor furnishes work during expansion. It is the purpose of this paper to compare the above methods of reducing the temperature of the gases, and especially to consider how such comparison is affected by variations in the efficiencies of the turbine and the air compressor.

The cycle of the type of gasoline turbine here considered is similar to that of the Diesel engine. The air is first compressed up to the maximum pressure. Fuel, either gas or oil, separately compressed, is then introduced and burned under pressure. The volume of the air is thereby expanded at constant pressure. After the burning is completed the hot gases expand adiabatically and the pressure drops. In the Diesel engine the expansion is incomplete, while in the gas turbine the expansion may be complete down to atmospheric pressure.

The efficiency of the above cycle may be readily found if both compression and expansion be assumed to be adiabatic. Let T_4 be the absolute temperature of the air just before compression; T_1 the temperature at the end of the compression; T_2 the temperature when the combustion is just completed; and T_3 the temperature at the end of the expansion. Assume the expansion to be complete. Then the ratio of the pressures at the extremities of an adiabatic change, sometimes called the compression pressure ratio, is the same for the expansion line as for the compression line. Denote this ratio by p. Let Cp denote the specific heat of air at constant pressure, and n the ratio of the specific heats.

Since the net mechanical work done equals the difference between the heat absorbed and the heat rejected during a complete cycle, it follows that the efficiency can be expressed thus:

$$\text{Eff.} = [C_p (T_3 - T_1) - C_p (T_2 - T_4)]/C_p (T_3 - T_1)$$
$$= 1 - [(T_2 - T_4)/(T_3 - T_1).$$

From the adiabatic relation,

$$T_1/T_4 = p^x = T_2/T_3,$$

consequently,

$$\text{Eff.} = 1 - (T_4/T_1) = 1 - p^y$$

where exponent $x = (n - 1)/n$, and exponent $y = (1 - n)/n$.

The interesting feature of this expression for efficiency is that the theoretical efficiency depends only upon the ratio of *compression*. It does not depend on the maximum temperature reached. Consequently, from a theoretical standpoint it makes no difference whether the fuel is burned with the theoretical amount of air or with a considerable excess. If a sufficient excess of air is used the temperature of the gases when they strike the turbine blades can be brought down to a value for which the strength of steel retains a high value.

When practical efficiencies are considered, however, it is found that the proportion of air to fuel becomes important. Of the theoretical power that can be developed, only a fraction is actually converted into mechanical power. Consequently a much larger proportion of the available power must be consumed in compressing the air than is allowed in the theoretical expression for efficiency. The greater the proportion of air to fuel, the more will the practical efficiency fall off from the theoretical. The question arises whether with practicable mechanical efficiencies for the turbine and the compressor a sufficient excess of air can be used to bring down the temperature of the gases to a proper value and still give a reasonable efficiency for the complete operation.

The velocity stage type of turbine seems best suited for use as a gas turbine. The gases may be expanded completely in a nozzle of refractory material down to their lowest temperature before striking the wheel. The calculations which follow will be limited to this type of turbine.

The formula for theoretical efficiency indicates that high compressions are favorable to efficiency. To produce high compressions it is practically necessary to use two-stage or three-stage compressors. It occurred to the writer that it might be an advantage to use intercoolers between the stages of such compressors. Calculations have accordingly been made for the purpose of comparing the efficiencies obtainable with intercoolers and without them, with the general result, as shown in the tables, that while theoretically the best efficiency is obtained by adiabatic compression without intercoolers yet with such values as are practically obtainable for the mechanical efficiencies of turbine and compressor the use of intercoolers is decidedly advantageous.

Calculations have been made for a two-stage compressor having total compression pressure ratios of 9 and 16, and for a three-stage compressor with a ratio of 27. The letter a is used when the compression is completely adiabatic, the letter c when the compression is adiabatic in each stage, but the air is cooled between stages, and the letter w when water is injected.

It is assumed that the temperature of the air entering the compressor is 531° F. abs., and also that each intercooler reduces the air to 531° abs. The pressure of the air at the beginning of the compression is assumed to be 14.7 lbs. per sq. in. abs., and the temperature of the gases leaving the expanding nozzle is assumed to be 1,200° F. abs., at which temperature the tensile strength of steel is about 10% less than at ordinary temperatures. It is assumed that the fuel used is a gasoline containing 15% hydrogen and 85% carbon, and that its calorific value is 20,000 B.T.U. per lb. The work required to force the gasoline into the compressed air is relatively small and has been neglected. The value of n taken was 1.4 for the air during compression. For the gases during expansion n has been taken as 1.39. The value of the specific heat at constant pressure is taken as 0.2375 for the air and 0.25 for the gases.

*From paper presented at the New York meeting (December, 1908) of the American Society of Mechanical Engineers.

Table I.—*Total Efficiencies for Various Mechanical Efficiencies.*
(Maximum pressure in lbs. per sq. in.).

Compressor efficiency.	Turbine Efficiencies.					
	0.70			0.60		
	a	c	w	a	c	w
0.90	0.19	0.21	0.17	0.11	0.14	0.13
0.80	0.14	0.17	0.16	0.06	0.11	0.12
	(p=9; max. pres.=132.2 lbs. abs.)					
0.90	0.20	0.24	0.21	0.12	0.17	0.16
0.80	0.15	0.21	0.19	0.06	0.13	0.14
	(p=16; max. pres.=235 lbs. abs.)					
0.90	0.24	0.29	0.23	0.14	0.21	0.16
0.80	0.18	0.25	0.20	0.08	0.18	0.14
	(p=27; max. pres.=397 lbs. abs.)					

An inspection of Table I shows that for all values of the mechanical efficiencies that seem obtainable at present, true adiabatic compression gives a lower total efficiency than either intercooling or water injection. It also appears that water injection gives a higher efficiency under some conditions than air dilution, while under other conditions the reverse is true.

The air used per pound of gasoline in the different cases is as follows:

For p= 9 condition (a).....66 lbs.
For p= 9 condition (c).....52 lbs.
For p=16 condition (a).....52 lbs.
For p=16 condition (c).....43 lbs.
For p=27 condition (a).....47 lbs.
For p=27 condition (c).....34 lbs.
For all values of p (w).....19 lbs.

What can be expected of the gasoline turbine in practice?

Air compressors of the piston type have been constructed which give a mechanical efficiency of 85%. The best mechanical efficiency obtained with steam turbines is in the neighborhood of 65%. Whether a velocity stage gas turbine of equal efficiency is possible can only be determined by actual trial. Some of the points of difference are as follows:

In the steam turbine, the wheel revolves in gaseous mediums varying from a considerable density at the higher pressures to a very small density in the vacuum at the exhaust end. In the gas turbine, the gaseous medium is at atmospheric pressure, but on account of its high temperature the density will be only a little more than a third of that of air under ordinary atmospheric conditions. It is quite possible that the wheel friction will be no greater on the whole for a gas turbine than for the best steam turbine.

The velocity of the gases leaving the expansion nozzle for a compression ratio of 27 would be about 4,600 ft. per sec., which is much higher than occurs in steam turbine practice. The effect of friction at such high velocities is yet to be determined. The experiments quoted by Professor Thomas in his book on Steam Turbines indicate that up to 220 lbs. per sq. in. pressure the percentage of friction loss in a properly shaped nozzle diminishes with increase of pressure. If this law continues, the use of high jet velocities may not detract from the efficiency.

It seems, therefore, within the range of possibilities to construct a gas turbine giving an efficiency of 60%, and a three-stage air compressor of 85% efficiency. Referring to Table I, the combined efficiency for air dilution with intercooling is found by interpolation to be 19.5%, and for water injection 15%.

In Bulletin 191 of the U. S. Department of Agriculture, Lucke and Woodward detail tests of engines using gasoline and alcohol. The smallest fuel consumption with gasoline was about 0.7 lb. of gasoline per brake horsepower, obtained only with the most perfect adjustment in a very few tests. The average fuel consumption was nearly 1.25 lbs., which propably represents more nearly the average practice. A fuel consumption of 0.7 lb. of gasoline per horsepower corresponds to an efficiency of about 18 per cent, while 1.25 lbs. corresponds to 10 per cent efficiency.

The gasoline turbine appears to offer advantages in reliability, comparative simplicity of adjustments, and freedom from annoying troubles as compared with the explosion engine. Whether it can compete with the latter in power developed per unit of weight remains to be determined. A further advantage over the explosion engine is that the gasoline turbine can burn crude oil, which is a cheaper fuel.

SEATTLE ELECTRIC IMPROVEMENTS.

Expending in lump sums $910,000 for new cars, $600,000 for new trackage and $275,000 for motor generators, transformers, high power transmission wire and lighting wires and fixtures, the Seattle Electric Company, which controls the street car and lighting of Seattle, will make a handsome record in handling the traffic and lighting of the forthcoming Alaska-Yukon-Pacific Exposition. The improvements, new lines, and new power facilities which the company is installing preparatory to the 1909 fair, mark a new era in street railway improvement in the Northwest, and at the close of the Exposition Seattle will be equipped with the most efficient service in the history of the city. For years the electric company has been kept at its wits end in maintaining schedules with its lines constantly impeded by street changes and improvements, not to mention increasing its service to meet the demands of a growing population. The present expenditures will leave the car system in excellent shape after the exposition, and will ensure a prompt and comfortable handling of the crowds at the Fair.

Four lines will tap the Fair grounds, two of which are now operating, with one more completed and the fourth just begun. Each line is five or six miles in length. All will be double tracked with loop terminals at the grounds, and a handsome terminal building and power substation will be installed on the Fair grounds. The company expects to be able to deliver passengers at the Fair grounds at the rate of two or three cars a minute in rush hours and on special days. As each car comfortably carries 100 passengers, the street railway system will be able to handle twelve or fifteen thousand persons an hour should the occasion demand.

The additional power necessary for these lines will be furnished by the great water power plant at Electron, on the Puyallup River, and the steam plant at Georgetown. Twenty miles of 13,000 volt transmission wire will connect this power with the substation on the grounds, where it will be stepped down to 2,300 volts. Two 1,000 kilowatt motor generators will be located at this station, and two others at substations in the city. The power will be sufficient to handle cars as rapidly as they can be safely moved over the four lines.

For the lighting of the exposition the same company has the contract, and is preparing a most elaborate illumination.

The substation on the fair grounds will be the source of current and all wires will be laid in underground conduits thus eliminating the unsightliness of poles or wires on the fair grounds.

The lighting power will come from the same sources as the transportation power. At the substation will be four 1,000 kilowatt transformers with the necessary regulators and switches. The outdoor or decorative lighting currents will pass through a rheostat, the plan being to turn on the lights all over the grounds gradually, starting with a mere twinkle and growing slowly into brilliant illumination. The water front on Lake Washington and the terraced hillsides overlooking the lake, with the wide avenues of the exposition leading down to the shore, will be brightly lighted, and the night scene from the water promises to be marvelously effective and inspiring.

STRUCTURAL DIFFICULTIES IN INSTALLATION WORK.*

By James R. Strong.

The subject assigned me is one seldom discussed; not because there are no structural difficulties in the installation of electrical wires for illuminating purposes, but because such difficulties do not usually arise for a considerable period after the installation has been put in use and these difficulties are then taken as a necessary accompaniment of the rigid type of present-day equipments.

It may not be a generally accepted fact, but it is nevertheless true, that the best electrical installation, from the point of view of the first-class contractor who intends to remain in business, is that installation which requires the least amount of changing and alteration after completion. Such an installation demands as a prerequisite a full knowledge as to exactly what is wanted as well as a complete scheme that will give the maximum desired results with a minimum maintaining charge.

In commercial buildings the interest on the installing cost is, of course, a factor to be considered; but this factor becomes very small in structures not strictly used for money-making purposes—as, for example, private residences.

Modern electric lighting installations in the better class of buildings are of some form of concealed conduit work, with iron or steel outlet boxes at the fixture locations. Therefore, the electrical equipment is as much a part of the structure of the building as is the plumbing or heating equipment, and any additions or alterations in the conduit work after the completion of the building must to some degree cause weakness in walls, floors, or plaster; to avoid changes in such electrical installations it is obviously necessary so to locate the outlets at the beginning of the work that all desired results may be obtained by the use of economical, artistic, and harmonious lighting fixtures.

The above requirements when first considered seem very simple and easy of fulfillment, and indeed they would form a simple proposition were all the conditions fixed; but, when on second thought one considers that every installation must or should be so designed as to allow a maximum amount of changes without affecting the efficiency of the results, the problem becomes more complex and worthy of the attention of all those who wish the lighting industry to make progress.

Take, for example, the floor of a typical office building and consider what it means to lay out the lighting system so that each new tenant with his special requirements, his different arrangement of high and low partitions, and his different style of furniture, may still have enough light of ample intensity and diffusion and at suitable locations.

It is not sufficient to dismiss the difficulty by saying that each new tenant should do his own shifting of outlets, for this is apt to mean a deterioration of the installation as a whole. It must also be borne in mind that in many cases it is quite impracticable to shift concealed conduit outlets, as, for example, in a ceiling where the iron girders are not more than one inch above the finished plaster line and the floor above occupied by other tenants. The necessary shifting, of course, could easily be done by the use of mouldings on the ceiling or walls, but this method at once cheapens the character of the work; not only are the mouldings not so safe or clean as conduit, but in moulding work it is very easy for irresponsible parties to cut into the work and make more or less dangerous attachments. It must also be borne in mind that if the outlets as already installed meet the demands of the prospective tenant the space may more easily be rented to advantage.

*A paper presented at the Second Annual Convention of the Illuminating Engineering Society, Philadelphia, Oct. 5, 6, 1908.

It would seem, therefore, that in designing the lighting for an office building the proper method of procedure is not the one frequently followed of arranging the circuits in each separate office irrespective of any consideration of adjacent rooms. Such a method is to be avoided, even though the space has been leased before the plans have reached the hands of the illuminating engineer. The better method is to consider each floor as a whole, bearing in mind the class of tenants who would be likely to occupy an office building in a given locality.

Office buildings are generally arranged with the main or high partitions midway between windows; a certain minimum size is selected for an office space, and the larger offices are multiples of such a minimum space. If, therefore, the outlets for general illumination are placed on the center line of windows, and if other outlets are placed around the ceiling a short distance inside the lines of partitions, it would seem as if every possible requirement could be met by simple fixtures, and the outlets not needed be capped up. This plan would probably involve a greater number of outlets in the original layout than absolutely necessary; but when it is considered that no changes would probably be required it will be appreciated that the additional first cost would be more than made up in saving in the maintenance cost of the first few years. Moreover, the installation as a whole would manifestly be a better one, owing to such freedom from changes and alterations, and as already pointed out, the offices would be more rentable.

The above general statements will also apply to any residence, in which class of work there seems to be a growing tendency to limit the number and capacity of outlets to the bare requirements of a scheme of decoration and furniture layout that has been decided on by the original owner, architect, or decorator, with no regard as to possible new requirements of a future purchaser or even changes desired by the original owner after he has become tired of a given color scheme or arrangement of interior.

Consider, for example, any room in a private residence where the original color scheme was light and the engineer depended upon a large co-efficient of reflection for walls and ceiling. Because of close competition the outlets were installed and the wires proportioned to just cover the above requirements. In a year or so the owner wishes the color changed to a dark tint, and there will be little or no reflection from the walls or ceiling. Then it becomes necessary either to exceed the requirements of the insurance code or to do additional wiring, with the attending cutting and patching and the possible weakening of studs or floor timbers.

If the outlets were installed in number and capacity sufficient for the darkest probable treatment, very little would be added to the first expense; and the decrease of the light to the exact amount required would then be done in the fixture and lamp.

Not only should the initial equipment be such as to cover any probable condition, but the outlets themselves should be so located that any re-arrangement of furniture is easy and practical. In a bedroom, for example, it has often been the practice to locate a ceiling outlet near the wall, or a side wall outlet near the ceiling, to provide for a dressing table fixture to light the face and hair. When subsequently the spirit of unrest takes possession of the occupant of the room and she wishes to change the position of the dressing table and the bureau, it is a difficult matter to rearrange the fixtures.

If, in place of the above special dressing table fixture, four side-wall outlets had been placed at the most probable locations of dressing table and bureau, then the articles of furniture could be interchanged at will, with very slight changes in the fixtures, and perhaps no change whatever except in the glassware. This plan would render the room

not only more attractive to its occupant, but would also assist in selling the residence to a prospective purchaser. It should be (and is) quite possible for the illuminating designer so to design a fixture and glassware that a side bracket on simple and attractive lines will accomplish for a dressing table all the results that are now claimed for the special dressing table fixture mentioned above, which special fixture is often recommended by some of the fixture companies.

Illustrations like the above could easily be multiplied, but it is believed that enough has been said to indicate the need of more attention to the elasticity of any proposed layout of conduit and wires for illuminating work, so that changes in the requirements for light will involve little or no changes in that portion of the equipment which forms a part of the construction of the building.

It is, of course, quite proper that the illuminating engineer should give his best skill to the design and arrangement of fixtures, glassware, and lamps at existing outlets so that the best possible results may be obtained in any installation which comes under his charge; and great credit is due our illuminating engineers for the advance made in this art during the last few years.

It is also true that in any installation where the layout of the outlets is under the engineer's charge, he must bear in mind that he is dealing not only with the science of illumination, but also with the vagaries of human nature. The love of change which seems inherent in the "Genus Homo" is as much a part of the equation as is the "flux of light."

The discussion of this—probably the most important—branch of the subject seems to have prolonged this paper unduly, and it is necessary for me to confine myself to the mere mention of certain other "structural difficulties." I do not wish to appear to criticize the valuable work being done by the electrical engineering profession here represented, but I feel that the mention of certain items which appear as "structural difficulties" from the contractor's standpoint may be a benefit to the profession as a whole. I refer particularly to the "specification" now written, to a large extent, by the consulting engineer and used by the contractor as a basis for his estimates. It is most desirable that this "specification" be made as simple and concise as possible, and that specialties should be avoided, such as the special stranding of wire different from the standard; extra heavy carrying capacity for switchboards and panel boards; extra spacing between conductors of different polarities; special outlet boxes different from the standard; the specifying of a particular appliance when several of equal excellence are on the market; the unfair clause requiring the contractor "to make any alteration of outlets requested without additional charge," and various other items along the same line. It is for the benefit of all concerned that electrical work be as near the standard as possible, and it will probably be conceded that the standards established by the underwriters are sufficient to insure safe and good construction. Standardization means economy and will unquestionably tend to minimize the cost of construction, and it must be admitted that the lower the cost of construction the more likelihood of the extension of the electrical field, which must prove of benefit to all interested.

WELDING COPPER.

Copper may be welded by using a mixture consisting of ten parts of borax, eight parts of carbonate of iron, and three parts of alum. This formula is the subject of a United States patent recently granted to James Crew, of Charleston, West Virginia.

Approved Electrical Devices

ATTACHMENT PLUG, FUSELESS.

"Peru" 3 A., 250 volts. Cat. No. 31286, and Separable Cap, No. 2286. Approved December 7, 1908. Manufactured by

Peru Electric Mfg. Co., Peru, Ind.

CIRCUIT BREAKERS.

"S. E." single pole type, for service on circuits not over 500 volts. Approved November 21, 1908. Manufactured by

Roller-Smith Company, 203 Broadway, N. Y.

FIXTURES.

"Benjamin" Tungsten Arcs, Indoor and Weatherproof Forms, 4 to 6 and 2 to 4 light types. Cat. Nos. T-44, T-45, T-45-K, T-46-K, T-62, T-63, and T-64. Approved December 7, 1908. Manufactured by

Benjamin Electric Mfg. Co., 42 W. Jackson Blvd., Chicago, Ill.

RECEPTACLES FOR ATTACHMENT PLUGS.

Surface Receptacles, 20 A., 250 volts. Cleat, concealed and moulding types, Cat. Nos. 5557-5559, inclusive. Flush Receptacle, 20 A., 250 volts, Cat. No. 5551. Approved December 1, 1908. Manufactured by

Harvey Hubbell, Inc., 35 Organ St., Bridgeport, Conn.

RHEOSTATS.

Drum Controllers for Industrial Service, including Types K for non-grounded circuits, R and T without primary oil switch attachment, all sizes, 125, 250, and 500 volts. Approved December 7, 1908. Manufactured by

General Electric Company, Schenectady, N. Y.

SOCKETS, STANDARD.

"Freeman" brass shell, key, 50 candlepower, 250 volts. Approved November 23, 1908. Manufactured by

Freeman Electric Co., Trenton, N. J.

SOCKETS, WEATHERPROOF.

G. E. keyless bracket types for 650 volt circuits; aluminum or brass shell, Cat. Nos. 50701, 50702, 25709, 25710, and 32440-32443, inclusive. Approved December 7, 1908. Manufactured by

General Electric Company, Schenectady, N. Y.

SWITCHES, AUTOMATIC.

Standard Automatic Time Switch, 25 A., 250 volts. A double pole, quadruple break switching apparatus consisting of two rods, the ends of which make and break contact with mercury wells in a slate block. Switch operated by a clock movement mounted in a wooden case with an inner steel box enclosing the switch proper. Approved November 23, 1908. Manufactured by

Standard Electric Time Switch Co., Sharon, Pa.

SWITCHES, KNIFE.

"Krantz" Knife Switches. Type H and HK, all capacities and styles, 125, 250, and 600 volts. Type PC, 0-100 A, 250 and 600 volts. Approved December 7, 1908. Manufactured by

H. Krantz Mfg. Co., 160-166 Seventh St., Brooklyn, N. Y.

SWITCHES, SURFACE SNAP.

"C-H" Surface Push Button Switch, single pole, 5 A., 125 volts, 3 A., 250 volts. Cat. Nos. 7100 and 7101 for moulding work. Cat. Nos. 7102 and 7103 for concealed work. Approved November 12, 1908. Manufactured by

Cutler-Hammer Mfg. Co., Twelfth St. and St. Paul Ave., Milwaukee, Wis.

Perkins "600" volt switches with "Vulcabeston" commutator. Single pole, five amperes. Cat. Nos. 2049, 2103, 2211, and 2212. Approved November 16, 1908. Manufactured by

Perkins Electric Switch Mfg. Co., Bridgeport, Conn.

JOURNAL OF ELECTRICITY
POWER AND GAS

PUBLISHED WEEKLY BY THE

Technical Publishing Company

E. B. STRONG, President
E. M. SCRIBNER, Vice-President and General Manager
A. H. HALLORAN, Secretary and Managing Editor

DIRECTORS

R. J. DAVIS A. M. HUNT E. M. SCRIBNER C. L. CORY E. B. STRONG

111 NEW MONTGOMERY ST., SAN FRANCISCO

TELEPHONE . . . . . KEARNY 918

TERMS OF SUBSCRIPTION

United States, Cuba and Mexico	per year,	$2.50
Dominion of Canada	"	3.50
Other Foreign Countries within the Postal Union	"	4.00
Single Copies, Current Month	each	.10
Single Copies, prior to Current Month	"	.25

NOTICE TO ADVERTISERS

Changes of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday for the paper dated Saturday of the same week. Where proof is to be returned for approval, Eastern advertisers should mail copy at least thirty days in advance of date of issue.

FOUNDED 1887 AS THE
PACIFIC LUMBERMAN, CONTRACTOR AND ELECTRICIAN

CONTENTS

A Plate Glass Switchboard 409
A description of a unique equipment for graphic illustration of switchboard connections. This article is a report of a talk by Mr. J. H. Clover, at the Electric Club, San Francisco, on December 12, 1908.

Westinghouse Receivership Ended 410

Examination for Electrician's Helper 410

Some Corrected Faults in Single-Phase Electrification 410
An abstract from a paper entitled "Log of the New Haven Electrification" which was read by Mr. W. S. Murray, at meeting of the American Society of Electrical Engineers, New York City, on December 11, 1908.

Obligations of Electric Companies in the United States to Place Guards Upon Their Wires . . . . *By Emerson W. Read* 413

Examination for Assistant Engineer of Tests 413

Some Possibilities of Gasoline Turbines . . . . . *By Frank C. Wagner* 414
An abstract of a paper presented at the New York meeting of the Society of Mechanical Engineers, December, 1908.

Seattle Electric Improvements 415

Structural Differences in Installation Work . . . . . *By James B. Strong* 416
This paper contains several points of interest to electrical contractors.

Welding Copper 417

Approved Electrical Devices 417

Editorial 418
The Value of a Mistake

Personal 419

Trade Catalogue 419

Patents 420
Alternating Current Switches.
Electric Light Cord Take-up.
Suction Dredge.
Tool For Electric Lamp Sockets.
Winding for Driving Electric Machines.

Industrial 421
New Westinghouse-Nernst Chandeliers.
Good Light is Practical Economy.
Errors in Water Meters.

News Notes 422

The Value of a Mistake

Last week Mr. W. S. MURRAY, told the American Institute of Electrical Engineers some of the inside troubles in the electrification of the New York, New Haven and Hartford Railroad, the first heavy traction, single-phase electric road in this country. The work had been without precedent—a pioneer blazing its own trail. When completed, it was found that certain deviations from the correct path had been made. These deviations, or errors, were corrected and the road put into successful operation. MR. MURRAY frankly acknowledged that mistakes had been made, but showed how the defects had been corrected. His remarks were as a guide post, showing which way not to go, a warning which is usually more useful than any number of directions as to which way to go.

Some critics are using these faults in the single-phase system as an argument against its adoption. Direct-current electrification offers a conservative path to the same goal. But in this very conservatism lies the greatest bar to progress. It is only by getting off the beaten path that we find new things; if nobody did anything there would be nothing done. If every one had followed the dictum that 500 volts were the correct pressure for a direct-current road, the new 1,200-volt electric railroad would have remained unknown.

Direct-current third rail is to be used in operating the Pennsylvania tunnel under New York City. This has been decided after an exhaustive series of tests of single-phase equipment, involving a painstaking comparison of the two systems. Yet it should not be taken as any reflection upon the merits of the single-phase electrification that the engineers thought direct current best suited for the service to be performed in this case. Was the first Atlantic cable perfect? Did it pay interest on the investment for the first year? Yet, in spite of adverse criticism, was it not carried to a successful conclusion? Single-phase is a new thing; some day it will be a big thing.

We cannot but admire the manly attitude of one who candidly admits that he has made a mistake, who has remedied the defect, and who will not make the same mistake again. By his fallibility we are the gainers. Knowing it, we are prevented from falling into the same error. But if we do not profit by his mistake, our own becomes an inexcusable blunder. There is a complementary rectification for every error which teaches the value of a mistake.

PERSONAL.

J. E. Woodbridge, of the railway department of the General Electric Co., is at the St. Francis.

George W. Goodrow, representing the Electric Goods Mfg. Co., of Boston, is in San Francisco.

Wm. Bancroft Potter, engineer railway department General Electric Co., is in San Francisco.

Bancroft Gherardi, engineer of the American Telephone and Telegraph Co., is in San Francisco.

Frank J. Sprague, consulting engineer of New York City, is at the St. Francis, San Francisco.

William J. Clark, general manager foreign department General Electric Co., is in San Francisco.

J. L. Mueller, traveling auditor for the Western Electric Co., spent the past week in San Francisco.

Geo. A. Scoville, San Francisco resident engineer of the Dean Electric Co., is in Southern California.

J. E. Bridges, of the Westinghouse Company, has returned to San Francisco from Los Angeles.

H. B. Squires, of Otis & Squires, has returned to San Francisco after a successful trip throughout the Northwest.

W. J. Davis, Jr., electrical engineer with the San Francisco office of the General Electric Co., left this week for a trip to Schenectady, N. Y.

Squire V. Mooney, manager of the San Francisco office of John A. Roebling's Sons Co., has returned from an extended trip East.

John J. Carty, chief engineer of the American Telephone and Telegraph Co., is expected in San Francisco the latter part of this week.

Thomas Collins, who is handling Westinghouse heating devices, has returned to San Francisco after a successful trip through Central California.

C. W. Dickinson, formerly with the Seattle Electric Company, has been elected president of the Pacific Engineering Company, vice C. B. Lamont, who goes to the Moran Company, of Seattle.

E. R. Lilienthal, of San Francisco, is acting president of the Northern Electric Railway Company, in Chico. It is reported that he will permanently succeed the late Henry A. Butters as president.

C. W. Burkett, chief engineer of the Pacific Telephone and Telegraph Co., has been elected chairman, and S. J. Lisberger, engineer of distribution, for the Pacific Gas & Electric Company, secretary of the San Francisco section of the American Institute of Electrical Engineers.

Herbert E. Stone has joined the Dearborn Drug & Chemical Works, as manager of sales in the Eastern department, with headquarters in New York City. Mr. Stone was formerly president of the N. A. S. E., and recently manager of the Pittsburg office of the Chapman Valve Company.

J. A. Lighthipe, electrical engineer for the Edison Electric Company, of Los Angeles, read a paper entitled, "How far can we go with automatic regulation on our electric system," before the Los Angeles section of the American Institute of Electrical Engineers on December 15, 1908.

W. R. Hewitt has resigned his position as chief electrician for San Francisco, after a service of twelve years. It is understood that William J. Nixon, who has been in charge of the department of electricity for several months, will be given the vacant position, and continue at the head of the department.

TRADE CATALOGUES.

Bulletin No. 1109 from the Fort Wayne Electric Works, of Fort Wayne, Indiana, illustrates and describes their multiphase alternators, revolving field, engine driven.

The Standard Roller Bearing Co., of Philadelphia, Pa., send an interesting catalogue displaying the varied applications of roller bearings in machine construction.

Circular No. 202 from The Veeder Manufacturing Co., of Hartford, Connecticut, shows the details of the Veeder straight reading speed counter, an instrument for finding the revolutions per minute of a shaft.

Western Electric Co. has recently prepared two booklets on the care and operation of direct-current motors and generators. One is devoted to Design "E" generators and motors, and the other to Design "L."

Bulletin No. 4630, recently issued by the General Electric Company, Schenectady, N. Y., contains a description of the company's direct-current portable instruments, Type DP, which have been designed for laboratory and general testing purposes.

As a convenience to customers the Electric Railway & Manufacturers' Supply Co., 84 Second Street, San Francisco, has issued booklets containing samples of the various kinds of tape and sleeving for electrical purposes that they carry in stock.

Westinghouse Type S Transformers are illustrated and described in Circular No. 1157 from the Westinghoue Electric & Mfg. Co., of Pittsburg, Pa. The Type S transformer employs a multi-circuit magnetic path, the distinguishing characteristic of the shell type construction.

The Electric Storage Battery Co., of Philadelphia, sends Bulletin No. 110, on the operation of "Chloride Accumulators" in connection with "Remote Control Oil Switches," and Bulletin No. 111, on "The Automatic Average Adjuster," in addition to a leaflet showing records from graphic recording instruments showing regulation of fluctuating A. C. load by means of (1) a battery of "Chloride Accumulators," (2) a split pole converter, and (3) an automatic A. C., D. C. exciter.

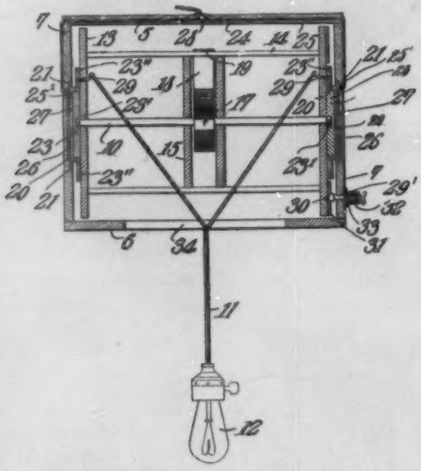
The General Electric Company has issued a bulletin devoted to the description of automobile accessories manufactured by that company, which will be of interest to automobile owners. The apparatus, briefly described and illustrated in this publication, consists of charging panels of various types, automobile instruments, automobile incandescent lamps, motor-generator sets, automobile motors and controllers, battery-charging rheostats, low-tension magnetos, air-compressor outfits, etc. Bulletin No. 4629 describes these accessories.

The 1909 edition of the "Westinghouse Diary," contains more information of interest to engineers and users of power apparatus than in any of the former editions. This includes data on high-pressure steam turbine, Leblanc condenser, low-pressure steam turbine, mechanical stoker, mercury vapor lamps, meter testing, storage battery, single-phase railway systems, tungsten lamps, turbo pumps and blowers, and Westinghouse-Nernst lamps. It is handsomely and durably bound in tan leather, and, in addition to the usual space for memoranda, contains some excellent maps.

PATENTS

ELECTRIC LIGHT CORD TAKE-UP. 906,286. Abraham W. Pratt, Eureka, Cal.

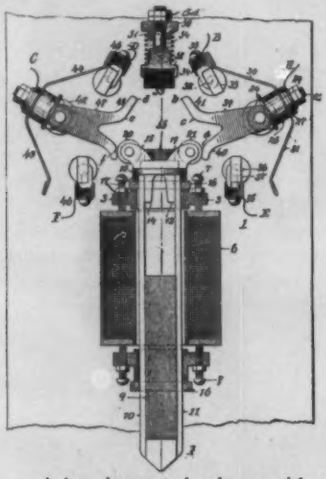
In a device of the class described, a supporting frame including end pieces having pockets formed therein, bearing sleeves secured to the end pieces at said pockets, said bearing sleeves constituting contacts, a spring-actuated reel



mounted for rotation within the supporting frame and provided with annular contacts engaging the bearing sleeves, a conductor having its terminals disposed within the pockets and bearing against said sleeves, and a suspension cord adapted to be wound on the reel and connected with the contacts of the latter.

ALTERNATING-CURRENT SWITCH. 906,317. Frank W. Smith and Louis Larsen, New York, N. Y.

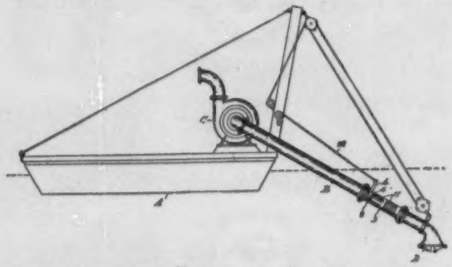
In combination with an electro magnet, a core movable in a right line, a circuit closer, and a pivoted bifurcated lever controlling said circuit closer, one of the arms of said



lever having a straight elongated edge; said core being constructed and arranged on the energizing of said electro magnet to meet said edge and thereby move said lever to cause said circuit closer to close circuit, and simultaneously to carry said edge into a position substantially parallel to the line of movement of said core.

SUCTION DREDGE OR THE LIKE. 906,234. Franklin H. Jackson, Berkeley, Cal., assignor to Byron Jackson Iron Works, West Berkeley, Cal.

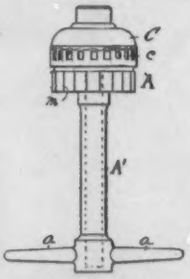
The combination with a dredge, and the tubular suction pipe thereof, of a valve guided and turnable upon the exterior of the pipe, said valve having alternate ports and



closed spaces, corresponding ports in the suction tube, and means by which the valve ports may be registered with those of the pipe.

TOOL FOR ELECTRIC LAMP SOCKETS. 906,408. Gilbert W. Goodridge, Bridgeport, Conn., assignor to the Bryant Electric Company, Bridgeport, Conn.

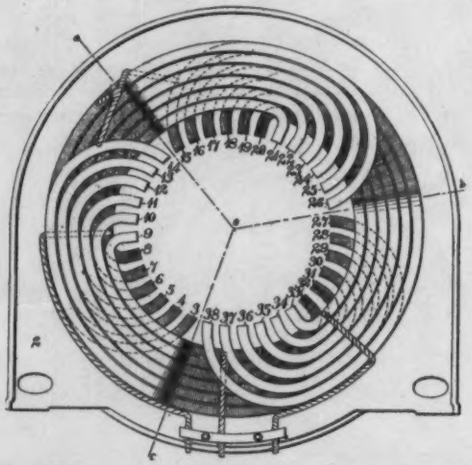
A tool for electric lamp sockets, comprising a handle



and a head with a hole through the head for the wires, the head adapted to fit into a socket cap and having parts to engage the cap rotarily.

WINDING FOR DYNAMO-ELECTRIC MACHINES. 905,900. George R. Maxwell, Pittsburg, Pa., assignor to Westinghouse Electric & Manufacturing Company.

A winding for dynamo-electric machines comprising a plurality of groups of coils having end connectors all por-



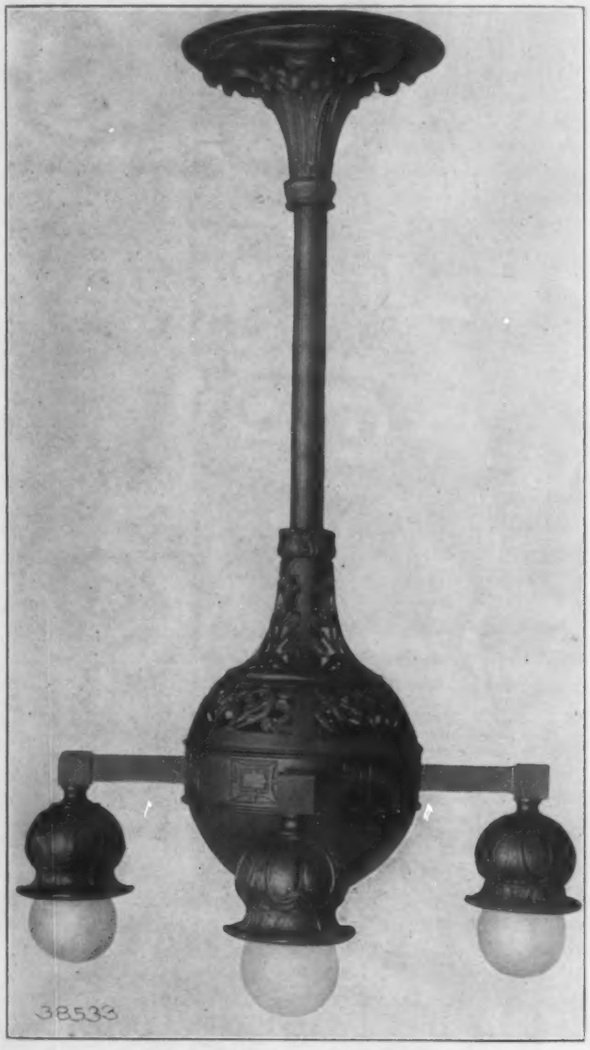
tions of which, except their extremities, are substantially concentric with the machine axis and the concentric portion of each of which has a single radius of curvature, the end connectors of each group being partially under the preceding and partially over the succeeding adjacent groups.

INDUSTRIAL

NEW WESTINGHOUSE NERNST CHANDELIERS.

Besides establishing a new minimum in the price of light of the best quality, the new Westinghouse Nernst system is responsible for the development of a line of chandeliers that give a greater volume of light for a small light source than it is possible to get with any other incandescent chandeliers ever made.

These chandeliers now being put on the market are made in highly artistic designs in Renaissance and Art Nouveau. They are made in solid castings or in a combination of castings and spinnings, and finished as standard in statuary bronze and satin brass.



New Westinghouse Nernst Chandeliers.

The novel feature about these chandeliers is the arrangement of the mechanism of the lamps in the central ornamental ball which conceals it completely and at the same time makes it easily accessible.

This leaves nothing at the ends of the arms except the small screw base burners, and these occupy less space than any other incandescent lamps of equal candle power. The 132-watt burner, for instance, giving light equivalent to that of seven 16-candlepower carbon filament lamps, occupies a space at the end of the arm, of only 3x4½ inches. This makes it possible to get a large volume of light without using a multiplicity of sources or infringing the law of proportions by making the sources too large for the other parts of the chandelier.

An order has been received by the Nernst Lamp Company for three-glower lamps to replace the six-glower Nernst lamps in the corridors of the Frick Building, Pittsburg. Nernst lamps have been used in this magnificent building for the past five years. The new lamps will give the same volume of light as the old at a saving of twenty-five per cent in the current consumption. Besides this, they have the advantage of greatly simplified renewal, at a material reduction in cost.

GOOD LIGHT IS FACTORY ECONOMY.

"Something like seventy-five per cent of the errors in the shop are made during the last hours of the day," said a well-known New England factory superintendent, recently.

"Why?—poor light. No workman can keep up his standard of efficiency when laboring under the handicap of poor light. And this is especially so in the late afternoon when a man is invariably tired. The strain of working by poor light is too much to ask of any one."

True.

If more factory superintendents would investigate this subject, they would soon be convinced that fully three-quarters of the waste time and spoiled material are directly chargeable not alone to inefficient light, but to bad placement and inadequate equipment of lights.

And if this waste were reduced to dollars and cents and hung in the balance against the cost of proper lighting equipment, it would be found that a single week's waste would be greater than the entire price of an up-to-date, scientific lighting installation.

Holophane-D'Olier Metal Reflectors are particularly designed for factory illumination. They will eliminate errors due to bad lighting. More; they will pay their cost in current saved, so that the lost time and temper and material that now go into the "cost of production" column of the ledgers will show under the heading, "Profits."

You doubt these statements?

Go into any shop within reach during the dark of the afternoon. Observe the light—or lack of light—under which the men are compelled to work. Watch them blink and strain their eyes; note the hesitation with which they set a tool or throw on power; count the lost minutes; see how often a piece of material is scrapped because of a false move.

Then, after noting the size and number of lamps that hang bare, figure out for yourself the saving that would follow the adoption of smaller lamps properly installed and equipped with Holophane-D'Olier Metal Reflectors.

ERROR OF WATER METERS.

In connection with the many tests made in various boiler plants with the object of determining the conditions of every-day operation and how increased economy could be obtained, the Coal Department of the Arthur D. Little Laboratory, Boston, have had occasion to calibrate several water meters. In one instance a hot-water meter read fifty-five per cent too low, another read thirty per cent low when passing 136 cubic feet per hour, and thirty-six per cent low when passing 102 cubic feet per hour. On account of the slip and leakage most of the meters read too low, but one case was found where a meter read 13.6 per cent too high. Even with a calibrated meter the results are questionable on account of the varying error at different rates of flow and the non-uniformity of feeding the boiler.

NEWS NOTES

FINANCIAL.

PHOENIX, ARIZ.—The City Cuncil has instructed the city attorney to draw up an ordinance offering for sale bonds to the amount of $60,000 for the construction of municipal waterworks.

SAN FRANCISCO, CAL.—The Public Utilities Committee of the Board of Supervisors will at the next meeting introduce a bill providing for the issuing of the $600,000 worth of bonds needed to cover the expenses of the preliminary action in the Hetch Hetchy water system. The bonds will not be issued until Congress has acted on the bill now pending confirming the action of the Secretary of the Interior in the matter of the grants made to San Francisco.

The monthly statement of the dividends paid by the oil companies operating and listed on the California Stock and Oil Exchange shows that the dividends for November reached a total of $17,393,773.

The Board of Supervisors of this city has declined the offer of the Spring Valley Water Company to place two supervisors on its Board of Directors, and has asked the company to submit to its stockholders the question of selling out to the city.

INCORPORATIONS.

LOS ANGELES, CAL.—The Hegyi Oil and Chemical Company has been incorporated here with a capital stock of $10,000 by Gabor Hegyi, C. M. Smith and A. C. Bollinger.

LOS ANGELES, CAL.—The West Side Oil Company has been incorporated here with a capital stock of $100,000 by W. Gillelen, R. W. Kennedy, G. W. Walker, W. D. Wilson and W. R. Wheat.

LOS ANGELES, CAL.—The Lake View Oil Company has been incorporated here with a capital stock of $100,000 by Julius Fried, C. E. Currier, F. C. Dunlap, R. D. Wade, C. F. Off, L. Robinson and J. P. Vawter.

RIVERSIDE, CAL.—The Gillman Home Company has been incorporated here with a capital stock of $50,000 for the purpose of developing, storing and distributing water. The directors are J. M. Gilman, Mattie B. Gilman and A. F. Gilman.

RIVERSIDE, CAL.—The Elsinore Oil and Gas Company has been incorporated here with a capital stock of $500,000 by J. A. Crane, C. S. Merrifield, L. H. Young, Chas. Hudson, J. A. Cline, J. S. Cobb and Hugh Walker, all of Elsinore.

LINDSAY, CAL.—The Lindsay Home Heat, Light and Power Company has been organized here for the purpose of erecting a gas plant for the lighting and to supply heat and power for this place. The company will erect a plant with a daily capacity of 6,000 cubic feet and a gas holder with a capacity of 20,000 cubic feet.

SAN FRANCISCO, CAL.—The Hawaiian Oil Company has been incorporated here with a capital stock of $250,000 by R. M. Sims, Edwin Schwab, W. C. Webb, Marion Vecki and R. C. Burnett.

The Honolulu Oil Company has been incorporated here with a capital stock of $1,000,000 by the same incorporators as the Hawaiian Oil Company.

OAKLAND, CAL.—The Sierra Electric Power Company has been incorporated here with a capital stock of $500,000. The incorporators are Frank E. Horton of Berkeley, Attorney Ben F. Woolner, T. C. Warren and Boyd L. Wilson of Oakland. Berkeley will be the corporation's principal place of business, and power will be brought to the bay for distribution from a large generating plant in the mountains.

TRANSMISSION.

SAN ANDREAS, CAL.—Mrs. Ellen M. Wetherbee has filed a notice of the appropriation of 100,000 inches of water from the Mokelumne River.

LOS ANGELES, CAL.—The Pacific Light and Power Company is arranging for the installation of a duplicate of its $1,500,000 power plant at Redondo.

PORTERVILLE, CAL.—It is understood that the San Joaquin Light & Power Company has bought a site for its power house on the Middle Tule River.

PLACERVILLE, CAL.—George L. Threkel has filed notice of appropriation of 10,000 inches of water flowing in the Middle Fork of the American River, for power and mining purposes.

LOS ANGELES, CAL.—The Board of Supervisors has passed an ordinance granting J. R. Gordon a franchise to construct and maintain an electric pole, wire, and conduit system in the town of Norwalk.

SAPPERTON, B. C.—The Royal City Gas Improvement Company has secured a site for its new plant at Sapperton, and construction work will be commenced as soon as the grading and excavation work is completed.

BAKERSFIELD, CAL.—When the matter of selling the electric lighting and power franchise in and about Delano came up, the Mt. Whitney Power Company was the only bidder and this company secured the franchise on its bid of $25.

OROVILLE, CAL.—The Great Western Power Company was not able to turn on the power in its first unit at Big Bend on the tenth as was planned, but it is now thought that the current may be sent to the Cowell Cement Works in Contra Costa County within a day or two.

TONOPAH, NEV.—Preliminary surveys for the proposed transmission line of the California-Nevada Power Company have reached the camp of Central, twelve miles from Manhattan. From that point lines will be run to Manhattan and Round Mountain. Three units of the company's plant have been completed.

SAN FRANCISCO, CAL.—It has been practically decided that the Board of Supervisors will, if it can be legally done, award the Byron Jackson Iron Works the contract for pumps and turbines for the new power stations and fireboats in the auxiliary fire protection system, though the bid of the D'Olier Company, of Philadelphia, was several thousand dollars lower. J. A. Lafore, sales manager of the latter company, will test the matter in the courts.

NORTH YAKIMA, WASH.—Franchises and easements along the county roads for an electric pole line to connect North Yakima with all the cities and towns of the lower Yakima Valley were granted to Robert E. Strahorn and the Yakima Valley Electric Company at the meeting of the board of County Commissioners. The new company will operate in connection with the Northwest Light & Water Company in supplying electric light and power to the other points in Yakima and Benton counties.

OAKLAND, CAL.—It is reported that there is an understanding between the Pacific Gas & Electric Company and the Great Western Power Company, and that there will be no cutting of rates between the two. It is also reported that the latter company will build no general distributing system in Oakland, but will sell direct to the former, and to large consumers only. Its largest consumer for the first year will be the Cowell-Portland Cement Company, which will furnish a market for about all that the Great Western will generate with its first unit. The cement works will start up in January.

TACOMA, WASH.—The Pacific Coast Power Company, of Seattle, recently filed a claim here for 2000 cubic feet of water per second on White River, near Alder, and announces it will construct a power plant in section 13, township 20, range 4 east, between Dieringer and Sumner. The construction of a power plant at the Nisqually falls, with a capacity of 20,000 horsepower, and costing $2,000,000, is being considered by the city. It is proposed to provide for initial expenses by a bond issue of $300,000 and the remainder to be paid out of the revenues derived from the plant.

REDDING, CAL.—The Lava Bed Power Company has secured from Roderick McArthur, of McArthur in this county, his right to 100,000 inches of water in Rall River, a tributary of the Pitt. The water is to be used in connection with an electric power project which, it is claimed, will involve the expenditure of about a million dollars. The water is to be carried through a tunnel four miles to the power site on the Pitt River near Peck's Bridge. This project is said to have no connection with the Gates plan for developing power at the big bend of the Pitt River twenty miles below Peck's Bridge. The latter calls for seven miles of tunnelling, the work on which is already under way though the land office has not yet acted on the company's application for a title to the site.

RED BLUFF, CAL.—Manager Johnson, of the Northern California Power Company, reports that additional machinery is now being installed in the company's plant at North Battle Creek which will increase the power generated there from 7,000 horsepower to 10,000 horsepower. Work has been commenced on the company's plant at Hazen on South Battle Creek and a high voltage line five miles long is being erected between the two sites. For the time being, this line will supply power for construction purposes at the plant on South Battle Creek and later it will transmit power from the latter to the North Battle Creek plant for transmission to Redding and Chico. Preliminary work has now been commenced on the company's third plant which will be at Inskip on South Battle Creek five miles below the Hazen plant with which it will be connected by a power line.

TELEPHONE AND TELEGRAPH.

PASADENA, CAL.—B. F. Kierulff, Jr. & Co. have secured a contract for 4,000 pounds of wire on their bid of $347.20.

SAN FRANCISCO, CAL.—The Standard Electric Construction Company has secured the contract for the wiring of the infirmary of the Almshouse for $3,750.

OAKLAND, CAL.—The Home Telephone Company has renewed its application for a franchise to extend its system into the country districts of Alameda County.

LOS ANGELES, CAL.—C. C. Galbraith, general manager of the United Wireless Telegraph Company, states that the steamer Hermosa of the Banning line will be equipped with wireless apparatus.

INDEPENDENCE, CAL.—Sealed bids are being advertised for for a franchise for a telephone system connecting this place with Lone Pine, Keeler, Darwin, Ballarat, Skidoo and intermediate points. Bids will be opened January 5th.

RED BLUFF, CAL.—The Government Forest Reserve station in this place will be connected by a Government telephone line with the station at Battle Creek Meadows about June 1st. Construction work on the line was begun last week.

OAKLAND, CAL.—The underground construction work of the Pacific Telephone and Telegraph Company in the Melrose and Elmhurst districts, which will cost about $30,000, will be carried out at once. An underground conduit will be laid from Twenty-third Avenue to Fruitvale. Aerial work to the amount of $70,000 will also be done.

WILLOWS, CAL.—The Glenn County Telephone Company has arranged for the construction of a brick office building at this place, the contract having been let this week.

ILLUMINATION.

PASADENA, CAL.—The City Clerk is receiving bids for furnishing 4,000 ½-inch cored carbons and 4,000 ½-inch solid carbons.

OCEAN PARK, CAL.—The Edison Electric Company has let a contract for the construction of a gas holder with a capacity of 300,000 cubic feet.

GRIDLEY, CAL.—Sealed bids are being received by the City Clerk for the furnishing and installing of an electric lighting system in this city, according to plans now on file.

ONTARIO, CAL.—A fifty-year franchise for a gas plant and distributing system has been offered for sale by the Board of Trustees, bids to be received till January 19th.

PRESCOTT, ARIZ.—The City Council has passed an ordinance granting a franchise to M. J. Hickey, Robt. Brow, and Henry T. Adams, for an electric lighting and power system here.

RIVERSIDE, CAL.—When bids for incandescent lamps were opened by the Board of Public Utilities it was found that five bids had been submitted, the prices named being identical.

LOMPOC, CAL.—The resolution granting to A. Genslein a gas franchise in this city, has been read for the first time in the City Council, and will, it is understood, be finally passed on December 27th.

LAS CRUCES, N. M.—The Board of Trustees has appointed a committee to confer with the Las Cruces Electric Light & Power Company in regard to the proposed 25-year franchise for that company.

PHOENIX, ARIZ.—The City Council and the Board of Trade have appointed a committee of citizens to investigate the cost of installing and other matters in reference to the installing of gas or electric systems in this city.

LOS ANGELES, CAL.—The Board of Public Works has ordered the lighting of Sunset Boulevard. The city will pay the cost of construction, the property holders on the Boulevard paying the cost of maintenance.

LODI, CAL.—The Lodi Natural Gas Company now has its well down 1,400 feet, and is expecting to find a flow of natural gas at a depth of 1,700 to 2,200 feet. Should gas not be found at a depth of 2,200 feet, the well will be abandoned and gas will be manufactured on the company's property.

HEALDSBURG, CAL.—The City Trustees, at their last meeting, awarded a contract for a new water-wheel for the municipal electric lighting plant, to the Pelton Water Wheel Company for $2,143, and another for a new dynamo, to the Westinghouse Electric & Manufacturing Company for $2,422.

ALAMEDA, CAL.—At the last meeting of the Electric Light Board, a contract for the laying of an oil pipe-line from Park Street and Encinal Avenue to the municipal lighting plant, was awarded to Powell Bros., whose bid was $3,241.50. The only other bidder was Couchot & Thurston, whose bid was $3,994.

WATERWORKS.

SAN BERNARDINO, CAL.—Sealed bids will be received till December 14th, for furnishing the Board of Water Commissioners 230 joints of 4-inch, and 170 joints of 6-inch standard cast-iron water-pipe.

LOS ANGELES, CAL.—Four bids have been received by the Owens River Aqueduct Commissioners, for the construction of the Antelope division of the aqueduct, but the award for the work has not yet been made. The bid of P. A. Howard for $530,000 appears to be the lowest.

GRIDLEY, CAL.—At a meeting of the Board of Trustees last week, bids were opened for water-pipe, hydrants, etc. The bidders included Fairbanks, Morse & Co.; Dunham, Carrigan

& Hayden; the National Wood Pipe Co.; the United States Pipe Co.; Pacific Coast Supply Co.; Crane Co.; the Joshua Hendy Iron Works; and A. L. Smith. The bids were referred to City Engineer Beebee for examination. Later, awards were made to the United States Iron Pipe Co.; to Dunham, Carrigan & Hayden; and to the Pacific Coast Supply Co.

YUBA CITY, CAL.—The Board of Trustees of this place have awarded contracts in connection with the proposed municipal waterworks as follows: Ninety-one-foot steel tower with 28-foot steel tank of 100,000 gallons capacity to Minneapolis Steel & Machinery Company, $5,250; concrete foundations for the tower to the same company at $9 per cubic yard; 5,265 feet of 8-inch pipe and 4,543 feet of 6-inch pipe at $32.28 per ton, 9,079 feet of 4-inch pipe at $33.28 per ton, 94 6 and 8-inch specials at 3¼ cents per pound, to the United States Pipe Company; for all wrought iron pipe, hydrants, valves, cocks, etc., to the Pacific Coast Supply Company; for laying 18,887 feet of cast iron pipe at 18 cents per foot and of 9,475 feet of wrought iron pipe at 12 cents per foot to W. Heafey and M. Murphy, of Oakland.

TRANSPORTATION.

SPOKANE, WASH.—Work has begun on the Spokane & Inland electric line to Opportunity and Vera. Jamison & McDonald are doing the work.

SPOKANE, WASH.—It is announced that the Spokane & Inland Railway may soon make an eight-mile extension up California Creek from gravel pit No. 2 on the Palouse line east to Mica.

SAN DIEGO, CAL.—The San Diego Electric Railway Company has 40 men at work on the construction of its Point Loma extension. The work is in charge of Superintendent of Construction Homer McNutt.

SAN FRANCISCO, CAL.—It is reported and generally believed that the long pending negotiations between the United Railroads and the Stanislaus Power Company have been concluded, the result being that the railroad company will secure all the power needed from the power company.

LOS ANGELES, CAL.—In view of the fact that the Pacific Electric road is accepting traffic and delivering loaded cars to railroads doing an interstate business, the Pacific Electric Railroad Company has filed tariff schedules on interstate traffic with the Interstate Commerce Commission, though there is some doubt as to whether these operations would be held to bring the road under the scope of the interstate commerce laws.

SACRAMENTO, CAL.—The Sacramento Terminal Co. has been incorporated with a capital of $250,000 to operate electric freight cars on the streets of Sacramento to the water front and across the river into Yolo County. The incorporators are Herbert W. Furlong and Chas. W. Harmon, of Berkeley, and John Leechman, W. G. Hyde, and Chauncey S. Goodrich, of San Francisco. The road is really the freight line of the Northern Electric, and will have a total length of 8¾ miles.

BERKELEY, CAL.—The blanket franchise over California, Ninth and Ellsworth Streets was sold to the Southern Pacific Company at the last meeting of the Board of Trustees for $25,000. This franchise will be used by the company in the extension and electrizing of its system in this city. At the same meeting of the Board, the franchise applied for by Duncan McDuffie for an electric line along Alameda and Marin Avenues was granted. This franchise will, it is understood, be used for an extension of the Key Route system.

OIL.

TONOPAH, NEV.—The Tonopah & Goldfield Railway Company is erecting oil tanks at various points for supplying fuel to its locomotives which are being fitted with oil burners.

COALINGA, CAL.—Ralph Arnold and Robert Anderson, of the United States Geological Survey, have published an estimate that approximately 2,825,000,000 gallons of oil underly the Coalinga district.

SANTA BARBARA, CAL.—About twenty-five producers of the Santa Maria district met here a few days ago and organized a sales agency along the lines of those at Coalinga and Bakersfield.

CARSON, NEV.—Governor Dickerson has been appealed to to send a squad of the State police to Salt Marsh, near Blair, to prevent trouble between the alleged owners of oil lands and claim jumpers.

SANTA BARBARA, CAL.—The Union Oil Company has made application to the Federal Government, through the War Department, for permission to lay a pipe-line from the company's property 2,000 feet into the ocean.

SAN DIEGO, CAL.—Under the supervision of Construction Foreman Kettle, the Los Angeles Union Oil Company has started work on the erection of a pumping plant, a warehouse and a group of large steel tanks for oil storage purposes.

SANTA BARBARA, CAL.—The Board of Supervisors have refused to take part in the fight being made to prevent the Union Oil Company from laying a submerged pipe line 2,000 feet long in the channel through which to pump oil from steamers to supply tanks on the mesa.

LOS ANGELES, CAL.—Mrs. A. E. Summers, of this city, has been in Kern County, contracting for heavy oil in the Midway and Sunset districts. For heavy Sunset oil she offered forty-seven and one-half cents, and for heavy Midway, sixty cents, or the same that the Associated Oil Company pays for oil of the same sort.

FRESNO, CAL.—Work is progressing rapidly on the storage plant of the Union Oil Company at this place. The warehouse for case goods is completed, and plans for the office building have been received. The steel for the foundations for the oil tanks is expected daily. There will be three tanks holding 900 barrels each and one holding 500 barrels.

SAN FRANCISCO, CAL.—W. A. Porter, secretary of the Associated Oil Company, denies the report from Bakersfield to the effect that the company is planning to build a pipe line across the State. He says the company has no surveys for such a line, has no intention of building a line, and has not even had the matter under discussion.

LOS ANGELES, CAL.—The Standard Oil Company has suspended work on all but one of its wells in the Topo district and on all but one in the Peachtree district along the line of San Benito and Monterey Counties, the reason given being that the wells were too closely bunched and that the completion of one in each district would sufficiently demonstrate the character of the land. The wells discontinued can be continued later if it is found that the work on the others justifies it.

TRANSMISSION.

BUTTE, MONT.—A preliminary survey has been completed from this city to Great Falls for a high power line for the purpose of transmitting power from the four dams to be constructed on the Missouri River near Great Falls by interests identified with the Amalgamated Copper Company to the mines at Butte and the smelters at Anaconda. All told the line will be about 225 miles in length.

GREAT FALLS, MONT.—Announcement was made in this city recently of the intention of the Great Falls Water Power & Townsite Company to construct two more dams across the Missouri River at Great Falls for the purpose of generating power. This announcement was made coincident with the filing at this place of two appropriations each of 1,000,000 inches of water per second.